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ORIGINAL ARTICLE

Doctors' beliefs and knowledge on corticosteroid-induced osteoporosis: identifying barriers to improve prevention

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SUMMARY

What is known and Objective: **Despite the availability of effective treatments for the management of corticosteroid-induced osteoporosis (CIOP), the condition is undertreated. Our objective was to assess prescribers' knowledge and likely prescribing patterns concerning the diagnosis and treatment of CIOP. Another goal was to identify key barriers to the use of preventive therapy in patients using long-term corticosteroids.**

Methods: **We used a postal survey of general practitioners (GPs) and specialists in the Netherlands. The survey comprised of questions on: demographic data, perceived barriers to the use of preventive therapy for CIOP, and knowledge of diagnosis and treatment of CIOP. Case scenarios were questioned to assess practice patterns.**

Results: **Responding prescribers correctly answered an average of 55% of knowledge questions and 69% of case scenarios. Multiple questions and cases showed that knowledge on the use of bone mineral density (BMD) determination was poor. BMD was determined in patients who, according to the national osteoporosis guideline, should be treated with bisphosphonates independent of BMD. Moreover, only 18% of doctors correctly answered that the BMD cutoff in CIOP patients is a *T*-score of ≤−1 or ≤−1·5. Key barriers identified were: (i) GPs, significantly more than specialists, consider prescription of preventive therapy the responsibility of another doctor; (ii) discontinuation of antiresorptive medication due to adverse effects and (iii) the reluctance to prescribe preventive therapy in patients already prescribed multiple medications.**

What is new and Conclusion: **Doctors did not identify many barriers to the prescribing of antiresorptive therapies. Lack of knowledge, especially concerning use of BMD-results, likely led to the under-treatment of the presented patients.**

***Keywords*: bone mineral density, corticosteroid, knowledge, osteoporosis, prevention, survey**

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WHAT IS KNOWN AND OBJECTIVE

Osteoporosis is a major concern for both the individual patient and to the general community due to increased morbidity, mortality (1,2), and financial costs arising from fractures (3). It has been shown that fractures can profoundly threaten the quality of life of the elderly, and the consequences of ignoring osteoporosis until fractures occur often are dramatic for elderly patients (3–5). Furthermore, the number of fractures is expected to increase in the community due to the world's ageing population (6).

A number of studies have reported decreases in BMD and/or an increase in fracture risk during oral corticosteroid treatment (7–9). Corticosteroid-induced osteoporosis (CIOP) is the most common type of secondary osteoporosis (10).

Despite the availability of effective treatments (11), CIOP is under-treated, even in high risk

groups of individuals who have suffered previous fractures (12). A recent systematic review of 24 studies between 1995 and 2006 showed that the average pharmacological prophylaxis rate was 31 ± 25% (range 1–86) for bisphosphonates, 41 ± 23% (range 7–86) for any antiresorptive treatment (excluding calcium and vitamin D) and 54 ± 30% (range 11–93) for any treatment (including calcium and vitamin D) (13). More recent intervention studies showed treatment rates for any osteoporosis prophylaxis (excluding calcium and vitamin D) of only 35% (14), 47·5% (15), 54% (16) and 57% (17) of patients at risk of CIOP.

The under-recognition and under-treatment of osteoporosis in general has been demonstrated in surveys to be related to physician, patient and healthcare system barriers (18). A previous study by Taylor *et al.* (19) demonstrated that surgeons regard primary care physicians responsible for any investigation and subsequent medical treatment of fracture. In addition, primary care physicians seem not convinced of the efficacy over the adverse outcomes and associated costs (20) and require more information regarding BMD testing (21). Patient factors have also been investigated, with perception and beliefs about treatment also contributing to the under-treatment or unwillingness to accept treatment (22).

In the Netherlands, due to its geography and healthcare system, most patients have access to BMD testing and to effective, affordable therapy. The Dutch osteoporosis guidelines recommend initiation of preventive therapy independent of BMD in patients using more than 15 mg/day prednisolone, in post-menopausal women or men >70 years using more than 7·5 mg/day prednisolone (23–25) (see Fig. 1).

There is evidence demonstrating the usefulness of academic detailing to increase prescription rates for patients prescribed corticosteroids (12). Although not directly investigated, a lack of preventive therapy in patients prescribed corticosteroids maybe due to doctors not being aware that corticosteroids increase risk of fracture, independently of BMD (26), and that patients receiving long-term oral corticosteroids should be considered for preventive therapy. The study of Werner and Vered (27) showed adequate knowledge on diagnosis and management of osteoporosis. However, only one question on CIOP was incorporated in the survey. The study of Buckley *et al.* showed that doctors' judgment of the risk of CIOP varied significantly by physician specialty (28). A Danish study by Nielsen *et al.* (29) showed that knowledge of the use of BMD, BMD cutt-off values, and corticosteroid dose and length of use in relation to prevention of CIOP is insufficient. Finally, a study by Guzman-Clark *et al.* (30) determined that barriers in CIOP management were lack of knowledge, having limited time, patient non-adherence and system problems.

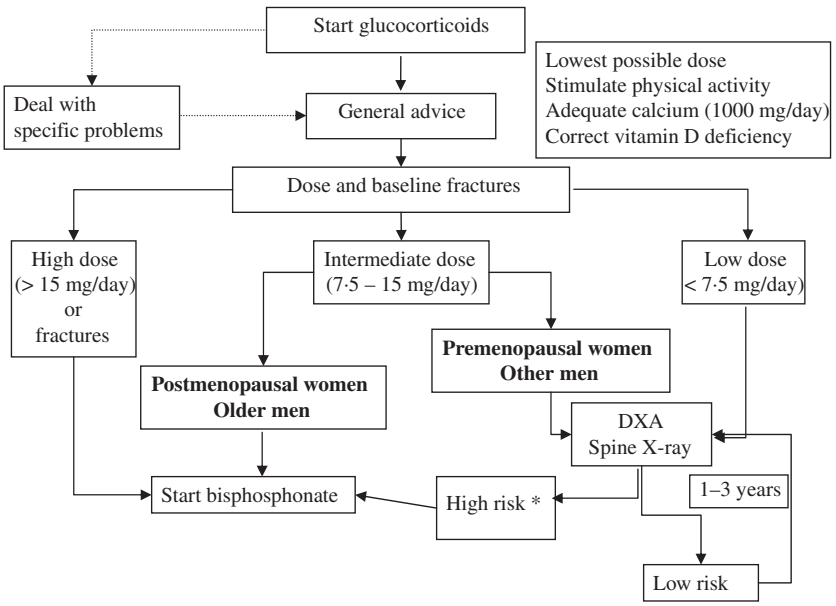

Fig. 1. Overview of Dutch CIOP guidelines (23–25). *Cut-off T-score <−1 or <−1.5 (24).

There have been no specific studies conducted regarding doctors' knowledge on CIOP in relation to treatment of (hypothetical) patients and barriers to the prevention of CIOP. Our objective was to determine the knowledge and likely prescribing practices of GPs and medical specialists concerning the diagnosis and treatment of CIOP. A second aim of this research was to assess general practitioners (GPs) and medical specialists perceptions of barriers to the use of preventive therapy (including patient barriers) in patients undergoing long-term corticosteroid use.

METHODS

A postal survey was undertaken among registered GPs and physicians from different specialties (rheumatologists, general physicians, orthopedic surgeons, respiratory physicians, gynecologists, neurologists, geriatricians and dermatologists) in the Netherlands. A pilot study was conducted in 2004 (31) and the final survey was administered in 2007. Respondents were included only once.

Doctors were sent a personalized letter of explanation and a survey. Replies were returned via an enclosed postage-paid envelope. A follow-up reminder letter was sent to all non-responding doctors approximately 1 month after the initial letter was sent. A brief preliminary section of the survey form dealt with the demographics of the doctor (years as doctor, age, sex, practice population (young, old, mix of young and old) and the use of Dutch CIOP guidelines (seldom or never, sometimes, always or regularly). Doctors were also asked whether they thought that CIOP was an important clinical problem.

The first section of the survey sought doctors' opinions on barriers to the use of anti-resorptive drugs. This section sought responses from statements on a 100 mm Visual Analogue Scale (VAS), with extremes marked 'agree completely' and 'disagree completely' and the possibility to mark 'I don't know'.

The second section of the survey consisted of questions to assess prescribers' knowledge of diagnosis and treatment of CIOP. In the 2004 survey, knowledge questions were answered using a 100 mm VAS, with extremes marked 'agree completely' and 'disagree completely' and the possibility to mark 'I don't know'. The knowledge questions in the 2007 survey were multiple choice, using simple statements like: 'True', 'False', 'I don't know' (see Table 3). The correct answers to the questions were determined using the existing Dutch guidelines (23–25).

There were 11 case scenarios using hypothetical patients prescribed corticosteroids given in the third section of the survey, in which doctors had to indicate what intervention they felt was appropriate (e.g., bisphosphonate, calcium and vitamin D, BMD-determination, etc.) (see Table 4). Strontium-ranelate became one of the treatment options only in the 2007 survey since it was not yet registered in 2004 in the Netherlands.

Statistics

The survey responses were treated anonymously, and data from all the responses were pooled. Upon receipt of the completed survey forms, the data were entered, stored and analysed. All analyses were performed using SPSS version 15 (SPSS, Chicago, IL USA). The VAS scores were transferred into scores using a five-point Likert-scale, selecting the nearest integer number on the scale. For the answers on the knowledge questions in the 2004 survey, the four outer scores, i.e. '(dis)agree completely' and '(dis)-agree', were transferred into Yes and No (depending on the question). A middle score was marked as 'I don't know'. Respondents that answered less than the arbitrary cut-off point of <15% of the questions of a specific part of the survey were excluded from the analysis of that part of the survey.

Differences between normally distributed data (e.g. years as doctor or age and type of doctor) were tested using an independent Student's *t*-test. Relationships between data that were not normally distributed (e.g., variables such as type of doctor and perceptions of barriers to the use of anti-osteoporosis therapy) were investigated using non-parametric statistical procedures (Mann–Whitney U test). To compare the relationships between type of doctor and categorical responses, chi-square tests or Fisher-exact tests were used. A *P*-value <0·05 was considered statistically significant.

RESULTS AND DISCUSSION

Of the 390 survey forms mailed to doctors, 114 were returned, yielding a 29% response rate. The

Table 1. Demographics from responding doctors

	All doctors (n = 114)	GPs (n = 88)	Specialists (n = 26)	P value
Mean age (years, range)	48 (35–60)	48 (35–58)	47 (36–60)	0.50
Sex: males (%)	68	69	64	0.67
Mean years registered (range)	18 (4–35)	18 (4–35)	18 (6–34)	0.89
Patient demographics (%)				
Young	7	8	4	0.13
Old	15	13	23	
Mix of young and old	78	80	73	
Use of Dutch CIOP management guidelines (%)				
Always or regularly	66	63	73	0.70
Sometimes	20	22	12	
Seldom or never	15	15	15	
CIOP is an important clinical problem; Yes (%)	92	89	100	0.48

CIOP, corticosteroid-induced osteoporosis; GPs, general practitioner.

demographics of doctors are shown in Table 1. Ninety-two percent of responding doctors indicated that CIOP was an important clinical problem. However, only 66% of responding doctors always or regularly used Dutch CIOP management guidelines. There were no significant differences between GP's and specialists.

There were few barriers identified to the prescribing of anti-resorptive therapy by doctors (Table 2). The primary concerns were: (i) GPs, significantly more than specialists, consider prescription of preventive therapy the responsibility of another doctor; (ii) discontinuation of anti-resorptive medication due to adverse effects and (iii) the reluctance to prescribe preventive therapy in those patients already prescribed multiple medications. GPs had significantly higher mean VAS scores when compared with specialists. Significantly more GPs felt their knowledge of the current guidelines was insufficient. This section of the survey also showed that 28% of doctors did not know whether patients intolerant of a bisphosphonate can be treated with another bisphosphonate (32).

The responses from doctors concerning their knowledge are shown in Table 3-A. The mean percentage of correctly answered questions per respondent was 55%. Sixteen percent of all doctors correctly answered ≥70% of the questions. Significant differences were shown between GPs and specialists in Table 3-B. There was no significant difference in the mean percentage correctly answered questions between the two groups.

More than 40% of respondents did not know that strontium ranelate and raloxifene were not approved for the prophylaxis of CIOP and whether or not the use of bisphosphonates is restricted in patients with impaired liver- or kidney function. It is remarkable that only 18% of doctors knew the correct BMD T-score cut-off for CIOP (≤−1 or ≤−1·5). This is confirmed by the fact that 36% of respondents disagreed with the statement that the diagnosis of CIOP can only be made if the BMD T-score is ≤−2·5.

Decisions to treat and the type of treatment chosen by respondents for various hypothetical patients prescribed corticosteroids (case scenarios) are shown in Table 4. It is apparent that the percentage of correctly answered cases increases when a BMD-measurement was performed and the patient had suffered a fracture. A patient with a T-score of −2·6 was most likely to receive adequate treatment. In the majority of cases the most frequent incorrect decision was an unnecessary BMD-determination. On average respondents treated 69% of patients according to the current guideline. Sixty-five percent of all doctors correctly answered ≥70% of the cases. There were no significant differences between GPs and specialists (data not shown).

Summary of main findings

The intention of this survey was to investigate the reasons for the discrepancy between guideline

Table 2. Perceived barriers to the treatment of CIOP by doctors

Barrier	All doctors (n = 109)		GPs		
	Mean + SD (median)	Don't know (%)	Mean + SD (median)	Specialists	P value
1. It's often the responsibility of another doctor (e.g. specialist or general practitioner, vice versa)	2.6 ± 1.4 (3)	2	2.9 ± 1.4 (3)	1.5 ± 1.0 (1)	0.002
2. Many patients cease therapy for osteoporosis prevention/treatment due to adverse effects	2.6 ± 1.3 (3)	2	2.7 ± 1.3 (3)	2.3 ± 1.5 (2)	0.17
3. Difficulty prescribing more medications to patients on multiple medications	2.3 ± 1.4 (2)	0	2.4 ± 1.4 (3)	1.8 ± 1.3 (1)	0.06
4. Patients are concerned about adverse effects from anti-osteoporosis medications	2.3 ± 1.3 (2)	7	2.3 ± 1.3 (2)	2.1 ± 1.4 (2.5)	0.72
5. Bisphosphonates have a difficult intake advice causing non-adherence	2.0 ± 1.2 (2)	2	2.0 ± 1.1 (2)	1.9 ± 1.5 (1)	0.41
6. A lack of interest by the patient for osteoporosis prevention	1.8 ± 1.2 (2)	2	2.0 ± 1.2 (2)	1.4 ± 1.2 (1)	0.06
7. There is a lack of time to discuss CIOP with the patient	1.8 ± 1.3 (1)	1	1.8 ± 1.2 (1)	1.8 ± 1.4 (1)	0.84
8. My knowledge of the current CIOP guidelines is insufficient	1.7 ± 1.5 (1)	0	2.1 ± 1.5 (2)	0.5 ± 0.5 (0)	0.001
9. Patients intolerant of one bisphosphonate should not receive another bisphosphonate	1.7 ± 1.3 (1)	28	1.9 ± 1.3 (1)	0.9 ± 1.0 (1)	0.002
10. The safety of the available medications could be better	1.7 ± 1.2 (1)	20	2.0 ± 1.2 (1.5)	1.0 ± 1.2 (1)	0.03
11. There are often contraindications to therapy	1.7 ± 1.1 (1)	3	1.8 ± 1.0 (2)	1.4 ± 1.3 (1)	0.03
12. The existing guidelines are difficult to translate into practice	1.7 ± 1.1 (1)	7	1.9 ± 1.1 (2)	1.1 ± 1.0 (1)	0.008
Mean ± SD per respondent (95% CI)	1.9 ± 0.7	–	2.0 ± 0.6 (1.8–2.1)	1.4 ± 0.8 (1.1–1.7)	0.003

Statements were translated from Dutch.
SD, standard deviation; CIOP, corticosteroid-induced osteoporosis; GPs, general practitioners. 1 = disagree completely; 2 = disagree; 3 = no opinion; 4 = agree; 5 = agree completely.

recommendations for CIOP and clinical practice. The study showed that 69% of hypothetical patients were treated according to the guidelines. However, on average, 55% of knowledge questions were answered correctly, with only 16% of doctors answering more than 70% of questions correct. Knowledge on BMD-determination and (relative) contraindications for bisphosphonate treatment were the main problem areas. The lack of knowledge of BMD-determination was confirmed by the hypothetical cases, as the largest percentage of doctors answered incorrectly that a BMD-measurement was necessary.

This study has identified several barriers perceived by GPs in the treatment and prevention of CIOP. Remarkably, specialists overall did not identify any barriers. Most striking was the perception by GPs that commencement of preventive therapy was the responsibility of specialists, while GPs often manage repeat prescriptions of corticosteroids. Other barriers were polypharmacy and discontinuation of medication by

Table 3. (A) Doctors knowledge concerning CIOP risk factors and treatment. (B) Differences in knowledge of GPs and Specialists concerning CIOP

		Response (%) n = 105		
Statement	Correct Answer	Correctly answered	Incorrectly answered	Don't know
(A)				
1. Strontium ranelate can be prescribed for the prevention of CIOP	No	10	49	41
2. What is the BMD cut-off value for treatment of CIOP (*T*-score: <−0.5, <−1, <−1.5, <−2, <−2.5)	<−1, <−1.5	18	46	36
3. Raloxifene can be prescribed for the prevention of CIOP	No	28	21	51
4. Supplementation of vitamin D in patients treated with bisphosphonates is necessary (yes, no, dependent on vitamin D blood-levels)	Depending on blood-levels	31	59	10
5. The diagnosis of CIOP can only be made if the BMD *T*-score is ≤−2.5	No	36	23	41
6. A patient with a GFR <30mL/min should not receive a bisphosphonate	Yes	46	13	41
7. A patient with a history of reflux, dyspepsia or GI-bleeding should NOT be prescribed a bisphosphonate	No	47	40	13
8. A patient with impaired liver function should NOT receive a bisphosphonate	No	50	4	47
9. BMD measurements can be used to determine therapy adherence	No	57	31	12
10. The deleterious effects on the bone from corticosteroids is NOT reversible	No	59	22	19
11. Inhaled corticosteroids increase the risk of bone loss and fracture	No	64	26	11
12. Corticosteroids increase the risk of fracture in the first 6–12 months	Yes	66	11	23
13. Corticosteroids increase the risk of fracture independently of BMD	Yes	74	12	14
14. Calcium supplements should usually be prescribed to patients who are treated for CIOP	Yes and depending on diet	76	11	13
15. A patient treated with a NSAID should NOT receive bisphosphonate therapy	No	82	5	14
16. Bisphosphonates are first line therapy for prevention of CIOP	Yes	86	5	9
17. Corticosteroids increase the risk of fracture ONLY if the dose is ≥15 mg/day	No	89	2	9
18. Patients with normal BMD and a high dose (≥15 mg/day) corticosteroid should NOT receive preventive therapy for osteoporosis	No	91	5	5
Mean percentage correct per respondent (SD)	55 (±17)			

Table 3. (Continued)

Statement	Correct response (%)			
	Correct answer	GP	Specialist	*P* value
(B)				
1. Strontium ranelate can be prescribed for the prevention of CIOP	No	4	33	0.01
2. 11. Inhaled corticosteroids increase the risk of bone loss and fracture	No	77	14	<0.001
3. 18. Patients with normal BMD and a high dose (≥ 15mg/day) corticosteroid should NOT receive preventive therapy for osteoporosis	No	97	70	0.03
Mean percentage correct per respondent (SD)		55 (±16)	55 (±23)	0.95

Statements were translated from Dutch to English.
SD, standard deviation; CIOP, corticosteroid-induced osteoporosis; BMD, bone mineral density; GP, general practitioner.

patients. Therefore, this study highlights that not only prescriber barriers but also patients barriers concerning adherence contribute to the low prevention rates of CIOP.

Strengths and limitations of the study

There are some limitations to our survey. The study size was limited, which limits generalization and statistical comparison between doctors. Respondents may be those with greater interest and knowledge in the area. As we did not obtain non-responder data, we cannot comment on responder bias. The response rate was 29%, similar to that achieved in other surveys of doctors treatment practices (33) and was considered acceptable considering the length of the questionnaire (8 pages) (34). For example an osteoporosis knowledge survey of Werner and Vered (27) showed a response rate of only 19%. Some respondents may have used references to answer the questions. This would, if they had not, have given a poorer picture of the respondents' knowledge. Finally, the questions concerning the use of raloxifene and strontiumranelate for CIOP could have been misinterpreted. Possibly doctors did not know whether the question meant: is licensed, is recommended in the guideline, or is evidence based. This might explain the fact that, respectively, 51% and 41% of respondents marked 'I don't know'.

The hypothetical educational cases, while having several limitations, offer a novel approach to identify doctors' behaviour with regards to treatment decisions and some of the possible reasons for under-treatment of CIOP. Another strength of our study was that determination of the correct answers for knowledge questions was based upon the prevalent Dutch guidelines and therefore represents testing of knowledge a corticosteroid prescriber is expected to have (23–25).

Comparison with existing literature

This study showed that 92% of responding doctors consider osteoporosis an important side effect of corticosteroids. In the study of Buckley in 1998, <50% of physicians surveyed listed osteoporosis as one of the three most significant side effects (28). This difference might represent an improvement of interest in osteoporosis, but could also be caused by methodological differences between the studies or differences between the investigated countries.

Polypharmacy was one of the more pronounced barriers in this survey. Doctors are often dealing with patients with complex medical problems requiring multiple medications and may not always consider osteoporosis prevention in corticosteroid users (35).

This survey identified that many doctors were unsure if a patient who was intolerant to one

Table 4. (A) Percentage correct answers for case scenarios of long-term users (10mg/day prednisolone). (B) Treatment decisions for case scenarios of long-term prednisolone users (10 mg/day prednisolone[a])

Case	Type of case scenario					Correct (%) (n = 103)
	Sex	Age	*T*-score	Fracture	Other	
(A)						
1	F	65	–	–	5 mg/day	42
2	F	45	−1.8	–		53
3	F	80	–	–		58
4	F	80	–	Vert	Early dementia	67
5	F	65	–	Wrist		72
6	F	65	−1.8	–		74
7	M	70	−1.8	–		74
8	M	70	−1.7	Wrist		79
9	F	65	−1.8	Wrist		81
10	F	80	–	Vert		82
11	F	65	−2.6	–		84
Mean percentage correct per respondent (SD)	69 (±27)					

	Case scenario (n = 103)										
1st Choice treatment (%)	1[a]	2	3	4	5	6	7	8	9	10	11
(B)											
Bisphosphonate (and calcium + vitamin D[c])	22	53[b]	54[b]	62[b]	56[b]	74[b]	74[b]	79[b]	81[b]	72[b]	84[b]
Repeat BMD 1 year	–	23	–	–	–	12	13	7	2	–	1
Determine BMD and possibly treat	42[b]	–	26	4	24	–	–	–	–	7	–
Determine BMD and treat with bisphosphonate	2	–	4[b]	5[b]	16[b]	–	–	–	–	10[b]	–
Calcium + vitamin D	6	8	7	10	0	6	5	7	9	2	3
Raloxifene (and calcium + vitamin D[c])	2	12	2	5	3	1	2	4	5	4	8
Strontiumranelate (and vitamin D[c])	0	0	0	2	0	3	0	0	0	1	0
Do nothing	16	2	4	7	0	4	3	1	0	2	1
Other	6	3	2	4	0	1	0	1	4	2	1
Don't know	5	0	1	2	1	0	3	2	0	1	3

T-score, outcome of bone mineral density determination; Vert, vertebral; M, male; F, female.
[a]Patient in case scenario 1 uses 5 mg/day.
[b]Correct answer.
[c]Depending on diet and sun exposure.

bisphosphonate can be treated with another bisphosphonate. Available data show that previously intolerant patients often accept bisphosphonate therapy upon re-challenge (36). In the Netherlands, data show that approximately 20% of patients cease taking alendronate after the dispensing of the first prescription (37). This might be due to adverse events or inadequate patient education.

Specialists and GPs displayed similar levels of knowledge relating to CIOP with scope for improvement. Similar to previous surveys (19, 30), GPs indicated (voluntarily) that more education is required to increase awareness and knowledge of CIOP. The use of inhaled corticosteroids and risk of fracture showed the greatest difference between GPs and specialists in our survey. The issue of whether inhaled corticosteroids increases the risk of fractures independently of the underlying condition they are treating (COPD/asthma) is vexing. Current evidence shows that when fracture risk is

adjusted for severity of disease, even high dose inhaled corticosteroids show no increased risk (38, 39). The difference between GPs and specialists might be explained by the fact that specialists see more patients using high dose inhaled corticosteroids and therefore see more CIOP, as, in real practice, they do not adjust for disease severity. However, because of the low number of responding specialists, this cannot be confirmed.

Of particular importance, 34% of respondents did not know that the risk of the onset of CIOP was greatest in the first 3–12 months of therapy. In the study by Nielsen *et al*., (29) only 23% of prescribers would start anti-osteoporotic treatment within 6-months of corticosteroid use. Moreover, only 18% of doctors correctly knew that the BMD cut-off values for treatment of CIOP are ≤−1 or ≤−1·5. The prevalent regional GP and Dutch rheumatologist consensus guideline on corticosteroid induced osteoporosis mentions ≤−1 or ≤−1·5 (24) as the cut-off values. The low percentage of correct answers might also be explained by the fact that the Dutch GP osteoporosis guideline (23) mentions no separate BMD cut-off value for CIOP. This guideline uses a *T*-score cut-off of ≤−2·5 for treating post-menopausal osteoporosis. The Dutch CBO osteoporosis guideline (25) did mention a *T*-score cut-off of ≤−2·5 for CIOP, with a note that the fracture threshold might be 1 SD higher. However, in the study by Nielsen *et al*., only 25% of respondents chose a BMD <1·0 as a treatment threshold (29), which is comparable with our results.

Examining the responses from the case scenarios, doctors were generally less likely to prescribe a bisphosphonate unless a BMD had been performed. Approximately, 21% of all doctors chose not to do anything for a 65-year-old women treated with 5 mg prednisolone (case 1), despite guidelines recommending BMD testing in women >65 years regardless of other risk factors (24, 40). This may be because, in the doctor's experience, patients may be unwilling to commence therapy unless a BMD is performed (41, 42). However, even in patients with a BMD *T*-score of −1·5 or lower, doctors were still hesitant to prescribe a bisphosphonate, unaware that the interventional *T*-score threshold to treat corticosteroid users is lower than for senile osteoporosis, as shown in the knowledge section.

Only 53% of doctors would start preventive treatment in a 45-year-old female using 10 mg/day with a BMD *T*-score of −1·8. A previous survey had already shown that for a 65-year-old post-menopausal woman using prednisolone (40 mg/day tapering to 20 mg/day), 80% of doctors would prescribe CIOP prophylaxis, while this was only 25 and 10% in a 45-year-old premenopausal female and a 45-year-old male respectively (28). The conclusion is that doctors seem to underestimate the risk of CIOP in younger patients.

WHAT IS NEW AND CONCLUSION

This survey disclosed only a few important barriers and reasons why some patients are undertreated, including the responsibility of GPs for repeat prescriptions of corticosteroids, polypharmacy and especially doctors' knowledge of BMD-determination. Lack of knowledge, especially concerning use of BMD-results, likely led to the under-treatment of the presented patients. There is a need for a larger study to be undertaken among doctors, as well as investigations into specific patient barriers in the use of osteoporosis prevention by corticosteroid users. Future studies should focus on interventions in patients selected based on risk in order to start preventive therapy. The effect of pharmacists or specialized nurses assisting prescribers on case-finding, therapy selection and non-adherence should also be assessed in future research.

COMPETING INTERESTS

None.

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